Theory, Policy, and Implementation of Scientific Learning on Geography Subjects In Indonesia

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Abstract
The biggest challenge Indonesia facing now is demographic bonus with population of productive age over 70% but in low level of education. The Government has made a breakthrough by implementing curriculum which is applying scientific learning models at various levels of education. This research tried to investigate the effectiveness, relevance, and balance between theory, policy, and its implementation. The descriptive approach was employed to interprete the data collected through interview, questionnaires, and classroom observation. Participants involved were 25 geography teachers. The results showed that the scientific learning model which combine the skill of the research process, the concept creative intelligence, and the theory of inquiry learning was elaborated into a rigid policy. Every teacher is required to perform the five learning steps of observing, asking, seeking data, associating, and communicating. This policy is told difficult to apply. Apart from being lack of media and learning tools in schools, teachers have misconceptions about the scientific approach. The teachers consider that the five scientific steps are not a syntax of learning but may be random and may take only one or two steps such as only observing and questioning. In several schools, its implementation tends to return to traditional methods of lecturing and questioning. In conclusion, theories, policies, and implementation of scientific learning, especially on geography subjects in Indonesia are less effective, not all relevant material is taught through scientific learning, and lack of balance between the theory developed and its implementation in schools.

Keywords: Geography, Implementation, Indonesia, Policy, Scientific Learning

Introduction

Scientific learning model is used as standard for national educational process in Indonesia. This policy, for many teachers is considered quite burdensome, because not all subjects can be taught through a scientific approach. There are three reasons for the Indonesian government to implement the policy, (1) to accelerate the improvement of Indonesian human resources quality in the era of the 21st century free market, especially in the context of ASEAN Economic Community (Anwar, 2014, 97-106). Scientific learning is expected to give birth to Indonesians who have critical, communicative, collaborative, and creative thinking skills as recommended in P21 Partnership for 21st Century Learning; (2) to increase significant economic growth between 5 - 7% in facing the demographic bonus transition period where the high number of productive age population (15-64 years) is more than 70% of the total population, but with the low level of education (antaranews.com), and (3)to erode the pragmatic attitude among teachers, which often work as it is without motivation, less serious in developing learners' character through education.

The third reason may sound strange, but the pragmatic attitude of Indonesian teacher has been criticized directly by the Vice President of the Republic of Indonesia, Jusuf Kalla. The vice president's concerns were addressed to members of the Association of Indonesian National Education Force (known as ALPTKNI) at the President's Palace on Wednesday, September 7, 2016. He said that almost every same occasion meeting with teachers representatives, improving the quality of education is not the main topic, but always about welfare, and the amount of certification allowances. The teacher's attention has begun to differ. Teachers now are more pragmatic (Prabowo, Kompas.com; 07/09/2016).

Is this policy on scientific learning getting positive responses from teachers? And whether its implementation in accordance with the theory and policy? This study tried to investigate the gap between theory, policy, and implementation of scientific learning in Indonesia. The content will be divided into three subjects about the relationship between theory and policy; theory and its implementation; and policy and implementation.

Theory & Policy

Theory of scientific learning was born and adapted from three different sources. First, it is influenced by the tradition of scientists in doing research in laboratory. Scientific learning steps are similar to the steps of scientific method. Starting from questioning, searching the data through experiments, observation, and analyzing data to answer the questions posed previously. Therefore, scientific learning has the same syntax as the scientific method of observing, questioning, exploring, associating and communicating. Second, it is inspired by the concept of 'DNA innovator' proposed by Dyers, J.H. et al (2011). The idea is that innovative entrepreneurs have something of a so-called 'creative intelligence', an intelligence that may be different from Howard Gardner's multiple intelligence types. They claimed that creative intelligence does not just rely on the right brain, but always involves both sides of the brain (right and left). They always utilize five inquiry skills to create new ideas in the economic field: associating, questioning, observing, experimenting, and networking. Third is from cognitive theory initiated by Bruner, Piaget, and Vygotsky. Bruner proposes a theory

of learning called discovery learning that says the individual will be considered to have engaged in learning activities when he or she has developed his or her mind. The development process are through three stages of thinking, enactive, iconic, and symbolic. Enactive stage is the stage of discovering something through motor knowledge such as children bite, touch, or grip their toys. The iconic stage is the stage in which one understands objects through visual object images, performs parables, and comparisons. Symbolic stage is the stage of the ability of children in language and logic, they have been able to have abstract ideas and ideas (Weibell, C. J. 2011).

The three ideas above are elaborated into a 'new theory' of scientific learning with five main steps: observing, questioning, finding Information/experimenting, reasoning/ Associating, and communicating which is easily called in Indonesian with the acronym of 5-M.

The policy about scientific learning is written in Regulation of the Minister of Education and Culture of the Republic of Indonesia No. 103 year 2014 Article 2 paragraph 8 on Learning in Primary and Secondary Education. The scientific learning approach are applied to all subjects that are regulated through the Regulation of the Minister of Education and Culture No. 22 year 2016 on Standard Process of Primary and Secondary Education. The table below how scientific learning steps are formulated from scientific method, the innovator's DNA and discovery learning.

Tabel 1: Steps Formulation On Scientific Learning

Scientific Method	The Innovator's DNA	Discovery Learning	Scientific Learning
• Purpose/Question • Hypothesis • Experiment • Data/Analysis • Conclusion Helmenstine, A.M. (2017)	• Associating • Questioning • Observing • Experimenting • Networking Dyers, J.H. et al (2011)	• Stimulation • Problem Statement • Data Collection • Data Processing • Verification • Generalization Mushtoza, D.A. (2016)	• Observing • Questioning • Finding Information/Experimenting • Reasoning/Associating • Communicating Regulation of the Minister of Education and Culture of the Republic of Indonesia No. 103 year 2014 Article 2 paragraph 8 on Learning for Basic Education and Secondary Education.

The above theories seem do not have significant difference on learning steps which start from the formulation of the problem, ask questions, search for data, analyze, and draw conclusions. However, there is one thing that escapes the attention that is difference in practice between the scientific method and the scientific learning. The scientific method as a research process is guided by certain questions and research variables. Researchers seek answer to research questions, and data analysis aligned with the hypothesis. While scientific learning has learning objectives, students have to

master a number of basic competencies, and analysis process has to be aligned with the learning objectives. At the observing stage, learners can be invited to observe and ask questions such as research questions, but when entering the finding information/experiment and associate stage, teachers and learners experience many difficulties. They are not able to collect data and associate it according to the diversity of basic competencies.

Such disability is reasonable because in scientific learning practice, teachers and students do not have sufficient capacity to collect data like a scientist. For example, on geography subjects there are materials about tectonic plates, soil solum, infiltration processes, climatic patterns, the distribution of the world's flora and fauna. It is impossible for students to do like a geographer does in those topics. For example to obtain simple data, such as the infiltration process, students need an infiltrating measuring device (infiltrometer), requiring energy, time, and great cost. Yet at the same time, they are required to achieve the learning objectives in accordance with the basic competencies that have been established. In the process of data analysis, the scientist will not come out of the proposed hypothesis, while in the scientific learning, the data analysis and drawing conclusion must be in accordance with learning objectives.

Based on the conditions described above, the scientific learning policy for all subjects in schools and all learning materials become irrelevant. The policy over-generalizes the issue with only one single solution. One of the subjects which has difficulty in applying scientific learning is Religion (Islam, Christian, Budhist, Hindu, and Kong Fu Tchu). Students will learn about the divinity, angels, heaven, and hell in these subjects. Teachers and students are not able to observe it because it is something supernatural. Unlike the subject of Religion, the themes in Geography subject can still be observed and researched, but because the study area is very wide which is below and above the earth's surface area of the planet earth and not all geographic study objects can be brought to the laboratory room but must be visited at a distance that may be very far away, it makes observing step difficult to be applied in class.

Theory & Implementation

The cluster of scientific learning according to the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 103 Year 2014 on Learning in Primary and Secondary Education are such as discovery learning, project-based learning, problem-based learning, and inquiry learning. Ones added other variety of scientific learning with two other types of case study and field trip. Participants in this study were asked to estimate the implementation of the scientific learning strategies and the answers is as below,

Tabel 2 Scientific Learning At Schools

No	Scientific learning strategies choosed by Geography teachers	Participants	Total Meeting	Meeting Frequency *)	%
1	Inquiry/discovery	25	16	128	32
2	Problem Based Learning	25	16	108	27
3	Project Based Learning	25	16	80	20
4	Case Study	25	16	76	19
5	Field trip	25	16	8	2
	TOTAL			400	100

*) the number of cumulative answers from 25 participants and from 16 class meetings

The above data is obtained with the assumption that geography teachers understand the theory and the nature of scientific learning (including its types of strategy). However, the level of understanding of geography teachers to the nature of scientific learning is in doubt because of the pattern of participants' answers as seen below indicating they are unaware of the nature of the scientific learning.

Table 3 Geography Teachers' Perception On Scientific Learning

No	Teachers' Perception on Scientific Learning	Frequency	%
1	The scientific sequence (5M) may be partially implemented and not necessarily sequential	7	25,64
2	The scientific sequence (5M) must be present at each meeting	2	12,82
3	The scientific sequence (5M) must be in order (not to be randomized)	1	5,13
4	Scientific steps can be selected in part only, not necessarily complete (5 M)	6	25,64
5	Teachers can choose one method (inquiry, problem based learning, or project based learning)	9	30,77
		25	100,00

The pattern of the answer above explained that the participants seem to have the presumption that scientific learning does not have to fulfill the five learning steps, not even needing a sequence. Whereas in its theory is very clear that learning steps are a syntax and must be pursued through the all five stages. This finding showed that there is a gap between theory and its implementation. Ones tried to trace the barriers to the implementation of scientific learning through the interview with the same participants. Here are several answers describe the barriers.

Participant 1: .... *not enough time. Five scientific learning steps (5M) with time available only 2 hours of lesson in one meeting not all steps can be completed. Observation activities for example, only a small number of students were able to understand (the problem). When they reading books or watching video students could not quickly capture the idea in a short time, especially when there are unfamiliar terms and words.*

Respondent 2: *.... the obstacle is the limitation of school's learning facilities. Moreover students were less motivated to learn actively, only some students were active.*

Respondent 3: *... the barriers lie in literacy culture, lack of learning facilities for students. Some students in class also cannot do their observation step because of limited time, facilities, and learning facilities.*

Respondent 4: *... too much administrative work to be done by the teacher. In case of students, not all of them have adequate learning facilities because many students are from poor family (ie. They cannot afford internet data cost).*

On the next occasion, ones also conducted class observations in two senior high schools (SMA PGRI and SMAN 6 Kota Bandung, West Java). Learning activities that were observed run smoothly in accordance with teacher planning. The objective of the observation focused on the teacher's strategy in managing the class in developing critical thinking, creativity, and developing good habits (character development) of students. From the observation, it can be concluded that the teachers are still accustomed to explain the Teachers can choose one method (inquiry, problem based learning, or project based learning) eaching material by way of deductive thinking. At that time, learning activities began with a number of notions about food, food security, and food sovereignty (Geography Class XI) and did not show in advance how to meet the daily needs of food.

In group discussion activities, teachers did not give detailed tasks so that many discussion groups were not effective. The discussions held were not product-oriented to be presented. Each group only wrote the presentation material on A5 paper with very small handwriting. At the time of the presentation, the presenter group only read their writing, so other groups tend not to notice even several students were engrossed in chatting with their friends. Classroom atmosphere were less conducive and less effective. Students also seemed less motivation to learn because the tasks they should do did not attract their attention. This suggests that the implementation of scientific learning has not changed much from the geography learning process in the past.

The Indonesian 2013 Curriculum has a mission to develop character education through indirect learning. At the time of learning, geography teachers are expected to advice, praise, reward, and become a model good habits, moral values, healthy living habits, curiosity development, entrepreneurial motivation, social care, and even a sense of love for the country. During the process of observation, teachers were still very rarely did the process of developing attitudes, characters, and habits of the students. Therefore, ones concluded that scientific learning in those two observed classes had not given the nurturant effect of learning in developing the character of the students.

Policy & Implementation

Government policy on scientific learning in general has not been accompanied by the fulfillment of adequate learning facilities and infrastructure, so that between policies and implementation still have gap. The interview result indicated that teachers felt not

optimal in implementing scientific learning because of the limitations of learning facilities while the ideal is that needs of facilities and infrastructure for supporting scientific learning on geography subjects such as internet network that can be accessed by students, library facilities with relevant book titles, computer room with a minimum number of 30 units, physical geography laboratory, and the environment around the school that deserves to be the object of observation are available and accesable. The basic learning tools required in the geography subject are LCD, computer, atlas, globe, aerial photograph, topographic map, compass, GPS, stereoscope, thermometer, hand-anemometer, rock comparator, CD or DVD player, weather monitoring equipment, seismograph. Although ones have not yet had primary data about the exact number available in the schools, but those numerous facilities are not always available at schools. Based on the above facts the scientific learning policy seemed still difficult to be implemented properly in the classroom.

The only reliable source of learning is the school library. The school library standard has at least one textbook per subject per student, one copy of teacher manual per subject per teacher of the subject, and 70% nonfiction and 30% fiction enrichment book. If the school has 3 - 6 study groups or classes, then the number of books that should be available as many as 1,000 titles of books. If the school has 7 to 12 study groups or classes, the number of books that should be available as many as 1,500 titles. If the school has 13 to 18 study groups or classes, then the number of books that should be available as much as 2,000 titles. However, in many school libraries, the number of books with titles relevant to geographic subjects are rare. This reinforces the fact that the policy is still not possible to be implemented in schools.

Table 4 Geography Teachers' Opinion On Scientific Learning

No	Pendapat guru	Frekwensi	%
1	Very easy to implement and does not take up time and effort	1	4,00
2	Normal, no trouble, and not time consuming	3	12,00
3	Difficult to implement perfectly at every meeting in class	4	16,00
4	Difficult to implement, only several part can be done (not perfectly implemented)	15	60,00
5	Difficult to implement, troublesome, and mostly can not be done in the classroom	2	8,00
	TOTAL	25	100

The table above shows that 60% of geography teachers still feel difficult to carry out scientific learning in the classroom. One reason may be due to the scarcity of school facilities and infrastructure in addition to the minimal number of books and low access to learning resources. From this fact it can be concluded that the 'spirit' of this government policy to apply scientific learning cannot yet be fully implemented by teachers in schools.

Conclusions

This research has identified the gap between theory, policy, and implementation of scientific learning on geography subjects in Indonesia. (1) Between theory and policy: there is an indication that the scientific method step is adopted 'extractively' (taking without changing its original nature or form) into a scientific learning syntax, whereas the practice of the scientific method as a research process works on questions, indicators, and variables research that are specific, while scientific learning has an obligation to achieve learning objectives with a number of basic competencies. Moreover, there is an indication of the generalization of the issue for improving the quality of education that seems to be solved by only one solution which is the scientific approach. (2) Between theory and implementation: participants have the notion that scientific learning does not have to fulfill the five learning steps, not necessarily sequentially, whereas learning is a syntax that must be sequential through five stages of learning. (3) Between policy and implementation: Approximately 60% of geography teachers in Indomesia still felt difficult to implement scientific learning in the classroom. Several reasons identified are due to the lack of learning facilities and infrastructure, the limited number of reference books in the school library, and the low access of students to other learning resources beside those two. The implications of the existing gaps between theory, policy, and the implemetation of the scientific learning are threat for 2013 curriculum to be 'failure.' However, this study has its limitation especially in the number of participants therefore to obtain accurate information there is a need to do further research by increasing the number of participants that spread in 12,513 senior high school (SMA) in all parts of Indonesia.

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